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COMMON SYSTEMS  
TIC DIGITAL LINE  
ORDER WIRE CIRCUIT

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SECTION I - GENERAL DESCRIPTION1. PURPOSE OF CIRCUIT

1.01 This circuit is associated with a TIC carrier route. It is designed to furnish voice facilities between repeater locations and terminal offices which will be used in the normal routine maintenance of the TIC system.

1.02 The order wire consists of a voice pair that parallels the TIC system route. Terminals for this pair are provided at each repeater case to which a 1013A handset may be connected. Talking battery for the handset is supplied over the voice pair from the control apparatus which is located at one end of the order wire.

1.03 The control apparatus in the central office connects the order wire to a dial subscriber line circuit under the direction of the 1013A handset when it is desired to

call attended test rooms in the area. The control also disconnects the order wire from the dial subscriber line circuit and furnishes audible and visual call signals to an attendant at the controlling office. Jacks are provided on the order-wire panel at the controlling office for communication between the office and the repeater locations.

2. DESCRIPTION OF CIRCUIT

2.01 There are a number of order-wire configurations which can be used to provide various features. Referring to SD-3C254-01, BD 2 shows a single order wire circuit with dial central office line a multiple circuit and/or a remote OW jack and indicator circuit. The multiple and remote order wire circuits are used to provide more access points without duplicating the control circuitry. Two order wire circuits and a single dial central office line circuit are shown in BD 1. Each order wire circuit still has the capability of driving multiple circuits and remote OW jack and indicator circuits. The telephone circuit in BD 3 does not contain any control circuitry; it is used to provide communications to any line which is already powered from another location. This circuit also has provisions for multiple extension circuits. The bridging and coupling circuit in BD 4 is used to couple two order-wire lines that are powered from their own source. The circuit has a bridge connection which can be used with a telephone set to provide local communications.

2.02 At each order-wire appearance along the cable route the craftsman using a 1013-type handset has the option of placing a call over the office switching network or connecting to a quiet termination. In order to gain access to the switching network, the linesman's telephone set is connected to the order-wire terminals. The switch on the telephone set is placed in the talk position and, after hearing dial tone, a call can be made.

2.03 To gain access to the quiet termination for talking between the central office panel and the line, or between line locations, the switch on the handset is placed in the talk position. After dial tone has been received, the office switching circuit is disconnected by placing the switch on the handset in the monitor position and waiting between 5 and 15

seconds and then returning the switch to the talk position. Timing circuits in the order-wire panel provide the logic to switch the circuit to the quiet termination mode.

**2.04** When the quiet termination mode is used, audible and visual service alarms are activated in the central office. A service alarm indicates that someone on an order wire requires assistance from the central office. The OW lamp on the order-wire panel or the remote indicator is turned on indicating which circuit has been activated. Plugging a 52-type headset into the OW TEL SET jacks on the order-wire panel connects the telephone circuit and establishes a talking connection between the central office and the cable route location.

## SECTION II - DETAILED DESCRIPTION

### 1. CIRCUIT CONFIGURATION

**1.01** There are four types of plug-in board assemblies: (a) the order wire and telephone set circuit, (b) telephone set circuit, (c) multiple circuit, and (d) bridging and coupling circuit.

**1.02** The order wire and telephone set circuit contains all the equipment necessary to establish a call either through the central office switching system or provide a quiet termination for other communications.

**1.03** The telephone set circuit provides the equipment necessary to communicate over any order-wire pair.

**1.04** The multiple circuit provides the equipment necessary to gain remote access to another order-wire panel or telephone set.

**1.05** The bridging and coupling circuit provides the equipment necessary to couple two individually powered lines together and also provides a bridged connection for local communication.

### 2. ORDER-WIRE LINE

**2.01** The TIC order-wire line is normally powered from -48 volts; the ring is connected to -48 volts and the tip of the pair is connected to ground through a resistance lamp. An extended range powering option is provided for either +48 or +130 volt battery feed.

**2.02** A network is in series with each order-wire field appearance to provide better current distribution when more than one handset is connected to the order wire at different locations. The network located in the repeater apparatus case consists of either a 536-ohm resistor or resistor network shunted by a 4.0 uF capacitor. The resistor and network prevent the telephone set closest to the central office from using

most of the available current, so that another telephone set may be connected to any other order-wire access point along the cable route and still have enough transmitter current to operate effectively. The capacitor shunts the resistor to make the circuit a low impedance to the ac speech signals.

**2.03** The maximum working length of this order wire, when powered by -48 volts only, is 10 miles when used over 22-gauge wire. For wire pair length up to 20 miles (#22 wire) 96 volt powering is required.

### 3. PANEL OPERATION USING AN ORDER WIRE AND TELEPHONE SET CIRCUIT

**3.01** Referring to SD-3C254-01, the L relay of the order wire circuit detects loop closure from the line and follows dial pulses received. To prevent damage to circuit from lightning hits and to provide current limiting for short circuits on the line, resistance lamps and gas tubes are provided in series with the L relay power loop. The L relay contacts close the circuit on the central office side of the T1 transformer and operate the central office line equipment and the A relay of this circuit. The A relay operation activates the timing circuit used to obtain a quiet termination.

**3.02** After dial tone has been received, any telephone number within the switching network can be called to request assistance when working on the TIC line.

**3.03** To obtain the quiet termination mode once dial tone has been received, the lineman's handset is switched to the monitor position for 5 to 15 seconds and then returned to the talk position. This mode is used when communication is required between the field and the central office or between field locations. Supervision is maintained by the L relay which controls the A relay. The circuit is equipped with two timing circuits which control access to the quiet termination. The operation of the A relay turns on transistors Q2 and Q5, driving the collectors low which discharges capacitors C9 and C11. Release of the A relay allows capacitors C9 and C11 to charge through resistors R12 and R17, respectively. When the threshold voltage of transistors Q3 and Q6 is reached, transistors Q4 and Q7 are turned on. The collector of Q4 goes low in about 3 seconds, providing a ground for the emitter of transistor Q8. While Q7 is high, Q8 is biased on and, if the A relay is reoperated after Q4 turns on but before Q7 turns on, the path through Q4, Q8 and the operated A relay contact operates the QT relay. The QT relay locks operated through closed QT and A relay contacts. Capacitor C10 delays the turning on of transistors Q2 and Q5, which allows time for the QT relay to operate. If the A relay is not operated

approximately 15 seconds before Q7 turns on, the base of transistor Q8 will be driven low so that the QT relay will not operate.

#### 4. ALARM AND LAMP CIRCUITS

4.01 The front panel of the order wire and telephone set circuit contains OW TEL SET jacks, a TEL SET IN jack, and an OW LINE jack. Also, there are ACO and OW lamps and an ACO key.

4.02 The OW TEL SET jack is used to connect a 52-type headset for central office communication. The TEL SET IN jack and the OW LINE jack connect directly to the input of the telephone set and the OW line to provide flexibility in patching between order-wire lines.

4.03 The OW lamp indicates which order-wire line is activated, and is lit whenever the panel is in the quiet termination mode.

4.04 The order wire provides contact closures to operate the office alarms when the order wire is placed in the quiet termination mode by field locations. Plugging into the OW TEL SET jacks lights the ACO lamp and turns off the audible office alarm. An ACO key is also provided to turn off the audible office alarm when the order wire is placed in the quiet termination mode for field-to-field communications. With the ACO key operated, the field still has access to the switching network. The ACO lamp on the order-wire panel and the visual service alarm lamp remain lit until the ACO key is returned to normal, all headsets are removed from the order wire circuit and the remote OW jack/s.

4.05 The telephone set circuit contains OW TEL SET jacks, a TEL SET IN jack, and an OW LINE jack. These jacks have the same function as the order-wire and telephone set panel.

4.06 The multiple circuit contains OW TEL SET jacks and an ACO lamp. This circuit is used with the telephone circuitry in the order-wire and telephone set circuit, or the telephone set circuit, and is just an extension of the headset jacks.

4.07 The bridging and coupling circuit contains an OW LINE 1 jack and an OW LINE 2 jack. The function of the circuit is to accouple two pairs of order-wire lines together. The OW LINE jacks provide a bridging point to provide local communication through a telephone set.

### SECTION III - REFERENCE DATA

#### 1. WORKING LIMITS

##### A. Battery Limits

1.01 The limits of the battery feeds are:

-48  $\pm$  5 volts dc  
+48  $\pm$  5 volts dc  
+130  $\pm$  5 volts dc

1.02 The normal current drain is 250 mA per order wire circuit. The panel is fused at 1-1/3 amperes.

##### B. Powering Range

1.03 The maximum length of the order-wire line when powered from -48 volts using 22-gauge wire is 10 miles. When used with a central office at each end, spans of up to 20 miles can be serviced by using blocking capacitors in the center of the span and an order wire circuit at each end.

1.04 The maximum length of the order-wire line when powered with 96 volts using 22-gauge wire is 22 miles. When used with a central office at each end, span up to 45 miles can be serviced by using blocking capacitors in the center of each span and an order wire circuit at each end.

#### 2. FUNCTIONAL DESIGNATIONS

2.01 The functional designations used are:

| <u>Designation</u> | <u>Meaning</u>                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OW                 | Order wire. When there is more than one order-wire panel in an office, this lamp indicates which panel is activated when an alarm is sounded.                                                                                                                                                                                                                                                                   |
| ACO (lamp)         | Alarm cutoff lamp. An audible alarm is sounded whenever the craftsmen on the line receive a quiet termination. This alarm continues to sound until the call is answered by either plugging in a headset or turning the ACO key for field-to-field communication. When the alarm is silenced in one of these ways, the ACO lamp will light, indicating that alarms are cut off. If the ACO lamp is on and the OW |

lamp is not, the ACO should be released so that the alarm will sound the next time a field location tries to initiate a call.

ACO (key) ACO key. A locking key that is used to lock out office alarms for field-to-field communications.

OW TEL SET Order-wire telephone set. A pair of jacks which is a connecting point for the 52-type headset to the order-wire line. Extra circuits bridged across an order-wire pair increases overall circuit loss; therefore, all unused headsets should be removed when not in use.

OW line A jack used in patching to provide direct access to the order-wire line.

### 3. FUNCTIONS

3.01 The T1C order wire circuit provides communication between field locations and the central office, the field location and any number in the switching network, or field-to-field locations.

3.02 Audible and visual alarm connections are provided to alert the central office that a field location requires assistance.

3.03 The field location maintains control and may call either through the switching network or directly to the central office.

### 4. ALARM INFORMATION

4.01 Alarm indications provided by the T1C order wire circuit may be either contact closure or a closure-to-ground. Audible alarms are initiated when the circuit is in the quiet termination mode and the ACO is not activated. Visual alarms are initiated when the circuit is in the quiet termination mode or the ACO is activated.

### 5. CONNECTING CIRCUITS

5.01 T1C Line - Application Schematic - SD-3C252-01

5.02 T1/OS - Span Terminating Circuits - SD 1C597 01

### 6. MANUFACTURING TESTING REQUIREMENTS

6.01 Manufacturing testing requirements for the J98725H order wire circuit are specified in X-78925.

### SECTION IV - REASONS FOR REISSUE

#### CHANGES

#### B. Changes in Apparatus

##### B.1 Added

FS 2  
APP FIG. 7

#### D. Description of Changes

D.1 FS 2 was added for remote access and status indication of the order wire.

D.2 In CPS 1, option T was added to make available information leases for remote jack and indicator circuit.

D.3 In BD1 and BD2, FS 2 was added.

D.4 In CAD 1, option T leads were added.

D.5 Circuit Note 102 was updated.

D.6 Circuit Note 107 was added.

D.7 APP FIG. 7 was added.

D.8 FS 1 was revised.

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